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THE COCOONING HABITS OF SPIDERS, ... *Theo. H. Scheffer.*

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THE COCOONING HABITS OF SPIDERS.

BY THEO. H. SCHEFFER.

INTRODUCTION.

THIS treatise does not aim at anything like a complete survey of the subject. The field is large, and the time spent by the author in going through its descriptive literature would not justify any assumption of completeness in the results gleaned. Then, too, the period of actual investigation prosecuted in the spiders' territory covered only a portion of one season—from August to December—among Eastern forms, and a single year among the spiders of central and western Kansas. Although in that limited time and in the two restricted districts it was possible to verify some of the statements or conclusions of writers on the subject, and to add something to existing knowledge, it is evident, at least to the writer, that several seasons' investigation in a wider range of spider territory should have preceded the preparation of a paper on this subject. However, the haunts of the Araneida are not forbidden ground and the investigator who is so disposed may add to or subtract something from this if he choose.

In general, the discussion will be confined to species included in the fauna of temperate North America, but characterizations of the habits of families will be drawn from these groups at large. The system of classification worked out by that veteran French writer, E. Simon, in his recently completed "Histoire Naturelle des Araigneés," will be followed in all cases where it has been possible to establish identity from the synonyms.

Of the twenty-five families of spiders assigned to temperate

North America by Simon, two, Hypochilidæ and Prodidomidæ, are very sparsely represented, and nothing is known of their cocooning habits. Some general statements can be made in regard to the habits of all the others, but in many cases no specific types can be cited. It is usually difficult, however, to say much in a general way about the habits of a family, for the larger subgroups sometimes take the liberty of differing widely among themselves in respect to methods of cocoon fabrication and care of eggs and young.

The term "cocoon," as used in this article, refers always to the silken sack used to enclose the spider's eggs. This explanation seems necessary, because in entomological discussions the word usually designates the case in which an insect undergoing metamorphosis passes its pupal life.

All type descriptions, with three or four exceptions, are based on personal observation. In the case of these exceptions credit is given to the observer.

GENERAL DISCUSSION.

Among all the creeping things none deserve less the popular odium and the ill reputation that attaches to them than the spiders. Superstition ascribes to them artful ways and dark designs; literature associates them with gloomy dungeons and venemous reptiles, while common ignorance invests them with various and sundry undesirable qualities. This is surely hard luck. The outcome of it is that the average newspaper correspondent lays at their door the death of every citizen whom a mysterious providence afflicts with septicemia—resulting from scratches—and children are taught to shun or destroy these interesting little spinners who could teach them more in a minute than an ant could in a week.

Although it is true that spiders will have to plead guilty to a natural ferocity that condemns each one to a solitary existence, and even adds the risk of life to the addresses of courtship, only a lack of knowledge concerning their habits can account for the low esteem in which they are generally held. Familiarity with their works and ways tends to raise these humble spinners many notches in the scale of our estimation. Certainly no class of insects, that nearly related group comprising more species than all the rest of the animal kingdom together, pre-

sents more interesting traits in a general way or shows more tenderness and solicitude in the care of its young than the Araneida. If it were the purpose of this article to defend the spider's reputation, much could be said that would tend to enhance our respect for them, but the limitations of the subject will permit discussion of their conduct along one line only.

Spiders interest themselves in various spinning operations; they make snares to trap their prey, silk-lined habitations to shield them from rough weather, drag-lines to serve as bridges and ladders, balloons to bear them aloft in their autumnal flights, fetters to bind the larger insects they capture, and silken sacks in which to enclose their eggs. The use of silk for this latter purpose seems to be almost universal, although many species omit one or more of the other industries from their line of practice. Many spiders use their silk for cocoon fabrication only.

The majority of spiders live but one year, and in their period of maturity each female makes but one cocoon to enclose her contribution to the perpetuation of the species. There are, however, many exceptions to this general rule. Some spiders are known to live several years, probably rearing a brood each season, and a number of quite common species, as the Labyrinth spider and the cobweb weaver of our house and outbuildings, lay their eggs at intervals during the summer, adding a cocoon each time to the collection or string.

In texture the egg-sacks vary from a simple mass of loose floss, through which the eggs can plainly be seen, to a structure whose walls are like parchment, close-woven, and stiff enough to protect the contents from rain and frost through the long, dreary months of a New England winter. The former class is represented by the cocoons of some of our common orb-weavers, such as those that stretch their webs between the timbers of bridges; the latter class is typified by the egg-sack of the Golden garden spider, a familiar object in the late autumn.

The modifications of structure to adapt the cocoon to season or environmental conditions are very obvious. Cocoons which are made for summer use only, or are sheltered in some way or protected by extraneous material, are less compactly woven than those meant for wintering eggs or young or those which occupy exposed situations. Again, the composition of the cocoon will depend to some extent on the care the mother spider is to give

it after the eggs are enclosed. Some species die shortly after they lay their eggs, leaving the latter to the vicissitudes of fate. This is especially true of those that mature in the fall, as do the majority of the orb-weavers; other species, particularly of the jumping spiders, stand guard over their treasures until the young emerge; while still others carry the cocoon about with them, clasped in their pedipalps or attached to the spinnerets. The least observing student of nature has no doubt quite often seen instances of this latter habit in the spring or early summer, when one may find the running spiders with their cocoons in the grass or under stones. A little later the young emerge and climb upon the mother's back, where they cling for a week or so, until they can shift for themselves.

The sites chosen for a fixed cocoon seem also to have some reference to the mother's future intent. Cocoons that are to be the objects of her watchful care are usually placed near the spot she has chosen as an abiding-place—in the snare, if she makes one, in the burrow or dwelling-tube, or in an incubation cell made expressly for the purpose. On the other hand, species that do not survive cocooning will go some distance to find a secluded spot under stones or bark, or in a rolled leaf. The protection of the cocoon in such cases, or occasionally even when guarded, involves the use of various extraneous coverings. Sometimes bits of dead leaves or sticks are employed; at other times fragments of captured insects, like trophies of victory, serve the double purpose of adorning and hiding the cocoon. Often fine earth or, still better, a mortar of clay completely hides the silken sack. Cocoons of this sort, as well as some others, are frequently suspended by a slender pedicle from a convenient support.

The parts of a cocoon seem to require separate mention. There are two types of outer envelope—one consisting of an entire, homogeneous piece, and one made up of two valves united at a more or less circular suture. This suture may be scarcely noticeable, or it may be a plainly marked zone of weaker tissue that stretches to make room for the young brood, and finally ruptures to permit the egress of the spiderlings. The method of manufacturing such an egg-sack is simple. A circular silken sheet of the proper size is woven, and upon this the eggs are laid. Another similar sheet is then spun over the

eggs and the two are united by their overlapping edges. The result is a biscuit-shaped affair in some cases; in others a cocoon that is almost perfectly globular. These are the portable cocoons referred to above. Within the outer envelope of the homogeneous type of cocoon may be one or more others, and on the inside, surrounding the eggs, is often a quantity of fluffy packing.

The contents of the cocoon next claim a share of our attention. Three conditions of the egg-mass obtain among the various species of spiders—the eggs may be free to roll about like so many dry peas, they may be entangled and held together by fine threads of silk, or they may be glued together into a more or less compact ball by a viscid secretion that hardens as it dries. This last condition seems to be an especially favorable one in which to pass the winter. Evidence of this is supported by the egg-masses of *Araneus trifolium* and the Spectacled spider of the East, which are not only held together but covered with a limy looking secretion.

The number of eggs varies greatly, depending largely, no doubt, on the chances for hatching and survival of the brood. We accordingly find the number greater when the eggs must pass the winter unhatched, or when they are not guarded by the mother spider. That this is not always true, however, is shown by the fact that some spiders whose eggs pass the winter without hatching lay but a few. The Triangle spider, for instance, encloses less than a dozen eggs in her compact, scale-like cocoon; but the latter is rendered so secure by reason of its protective coloring, in addition to other things, that probably nearly all the eggs hatch in the spring. Certain spiders which carry their eggs about, or shut themselves up in a cell with them, lay not more than three to five. The other extreme is represented by species such as *Argiope aurantia*, whose cocoons, containing from 1000 to 1200 eggs, hang unprotected from the tops of dead goldenrods through the storms of winter.

The large, burrowing Wolf spider, which sometimes lives in our gardens, lays from 500 to 600 eggs, enclosing them in a globular cocoon. For this treasure the mother will fight desperately, refusing to surrender or desert it even when her legs are torn from her body. Her devotion is born of instinct, however, and not of reason; since it is an easy matter for an

observer to impose upon her lower order of intelligence by substituting a bogus cocoon of pith. This she will regard with the same marks of tenderness she bestows upon the silken sack freighted with the hopes of her posterity.

In color the eggs show some variation among the species. The prevailing tints are whitish or yellowish, though shades of red and brown are not uncommon. Even violet tints are ascribed to the eggs of certain species.

With spiders, as with animals of higher and lower types, the operation of the laws of natural selection begins with the eggs. These become the food of other spiders, or of birds and predaceous insects. Thus their numbers are greatly reduced. Out of 600 cocoons of *Argiope aurantia*, collected by Professor Wilder on one occasion, less than 150 were entire, the others being torn or pierced. Parasitic Hymenoptera of several species also seek out the cocoon, puncture the walls, and lay their eggs there, so that their larvæ when hatched may find a supply of food at hand. In the autumn months it is the exception, rather than the rule, to find, in some classes of cocoons, one that is not parasitized. The spider's revenge occasionally comes in the form of a secondary parasite, that, in turn, treats the first invader as she had treated the original cocoon builder.

When the young spiders have hatched their troubles have only begun. In addition to the dangers that threaten the eggs others await them. For example, if we are to accept the doubtful conclusions of some observers, they have to be on the watch lest they fall a prey to the appetites of their larger and stronger brothers. Cannibalism within the cocoon is, however, not an established fact; more evidence than that already gathered is necessary to prove that it exists.

Field observation reveals the fact that spiders pass the winter in one of three states—in the egg, as already referred to, as newly hatched young in the cocoon, or as half-grown spiderlings and adults in various shelters. Ordinarily, in summer, the eggs hatch in from fifteen to thirty days, the time varying with the species, but when they are laid in the autumn they may not hatch until the following April or May. Of course, only those young which hatch in the warm season and emerge from the cocoon soon after can receive any care from the mother spider. That such broods are cared for with the greatest ten-

derness and solicitude is a matter of common observation among such families as the Lycosidæ, the Dictynidæ, and the Salticidæ. In the first of these families the young remain with the mother for as much as two weeks, being carried about by her as they cluster on her back. The salticids seal themselves up in a silken sack with the eggs, and when the young hatch remain with them for a long time. The young dictynids occupy the maternal snare for weeks, and without doubt are afforded some protection and material help. Further observation will most certainly establish the fact that spider mothers of many species capture and bring food to their young, as do birds to their nestlings.

DISCUSSION BY FAMILIES.

Family AGELENIDÆ.

This is a family of sheet-web weavers, represented in our fauna mainly by the two genera, *Agelena* and *Tegenaria;* the former found in open, grassy fields, the latter in sheltered places, including barns, cellars, and outbuildings. There is some difference between the two genera in cocooning habits. Species of the genus *Tegenaria* construct cocoons whose exterior envelope is homogeneous and continuous—not made up of two valves. These cocoons number two or more usually, and are in the shape of a flattened ball or are nearly globular. They are placed either in the web, being suspended from it, or on some object near the web. Sometimes this object is a little silken hammock made especially for the purpose. It is very common, also, to find the cocoon covered with bits of plaster, clay, or debris of some sort. This habit of garnishing the cocoon on the outside, or that of putting dirt between some of the envelopes, seems to obtain throughout nearly all the genera of the family.

The cocoon of the genus *Agelena* is more flattened, generally plano-convex. It separates, when one attempts to tear it, into two valves—a lower, silken rug or pad on which the eggs are placed, and a covering of two or more layers of floss separated by foreign debris. It is ordinarily attached by the plane face, but Miss Staveley reports a species (*Agelena brunnea*) that suspends it by a stalk from a twig. Some species place the cocoon

in a closed cell in or near the web, while others lodge it in sheltered places remote from the snare.

Beyond making careful provision for the seclusion and protection of her eggs, the agelenid mother can do nothing for the next generation, as she rarely lives to see her offspring. The females of most species die in the fall or early winter. *Tegenaria civilis*, however, is known to live four years, producing many broods (Staveley).

TYPE: **Agelena nævia.**

This is a very common species, which makes its sheet web, with funnel retreat, in grassy fields, in brush piles, or in nooks and crannies in and about buildings. The eggs are laid in September and October. At this time the females collect together in great numbers under the bark of dead trees or fence-posts, under loose rocks, and in angles of buildings and like places. Here their cocoons are grouped so close together as to often overlap—as many as forty or fifty sometimes being found on a space as large as one's two hands. The cocoon itself is a low, hemispherical patch, approximately three-fourths of an inch in diameter, attached by the flat face. Sometimes, also, the highest point of the convex surface is attached. It is white in color, and one can readily distinguish the following parts: A closely woven rug on which the eggs are placed, over that a circular covering, and then two more light silken blankets, with a layer of dirt or wood chippings between. This layer of debris shows through the outer covering as grayish protuberances. The dead bodies of the females are usually found on or near the cocoons. The eggs are cream-colored, not agglutinate, and number about 200. The young hatch in the early spring, and leave the cocoon some time in April.

TYPE: **Coras medicinalis.**

A species very frequently met with the year round. It lives in sheet webs under rocks, tangled masses of roots, overhanging banks, and other like shelters in the woods. The cocoons are spun in early summer. In all cases noted they were suspended, or rather entangled, in the web, which was drawn up at the edges and sagged somewhat in the center. This sagging is caused by a mass of fine, dry dirt, bits of leaves and

other trash held together by a loose outer spinning work enclosing the cocoon proper. The latter is nearly spherical, about one-half inch in diameter, and has more dry dirt interwoven in its envelopes. The inside is soft, cottony, and pure white. It contains about 125 white eggs, which are not agglutinate. The mother spider remains in the web with the cocoon, carefully repairing any damage to the supports of the latter.

Family ARGIOPIDÆ.

It would not be practicable, or perhaps even possible, to say anything in a general way about cocooning habits in this family. It is by far the largest group of Araneida, and its numerous species have been arranged in very many subfamilies and supergenera, some of which are themselves larger than other entire spider families. We can, however, arrive at some knowledge of the diversified cocooning habits of these orb-weavers by a comparative study of a number of types.

TYPE: **Araneus labyrintheus.**

The Labyrinth spider spins, in addition to the regular orb, a barrier web consisting of a maze of intersecting lines. Near the top of this labyrinth the female fastens her string of five or six cocoons. The first of these is spun about the middle of August, and the others added at intervals until late in October. When the leaves have fallen and the early winter winds have torn the webs to shreds, the strings of cocoons can easily be found attached by three or four tightly stretched lines radiating to the tips of twigs on bushes or low trees. These supporting lines are strong enough to sustain the weight of the branch to which they are attached, when the latter is broken off. The cocoons are placed so close together as to overlap for half their width, and the whole string is usually protected by bits of leaves or a light silken sheath. Each cocoon is composed of two valves—a short, oblique, conical case for the eggs and a slightly convex cover, about three-eighths of an inch in diameter, for the same. Both basal portion and cover are of paper-like texture, the former light brown in color, the latter gray. The eggs are further protected by a light packing of fluffy brown silk in the interior of the case. They are yellowish red, adhere slightly, and number twenty-five or thirty in each cocoon. The young

spiders hatch in the fall, but remain in the cocoon until the following spring. In November one may find strings in which the older, upper cocoons contain young spiders with color markings, the intermediate cocoons pale, newly hatched fellows, while the lower cocoons still have eggs. The mother spider maintains her position immediately below the lowest cocoon of the string. She disappears, however, at the approach of winter, and probably perishes.

TYPE: **Araneus trifolium.**

This is one of the largest of the orb-weavers. The web is stretched between two bushes or tall weeds in some wet, shrubby pasture. I have not been able to determine the cocooning site, although I have searched carefully on several occasions. During the last week in September and the first week in October I secured a number of cocoons from females imprisoned in the college insectary. They are inverted-dome-shaped affairs, a little greater in depth than a hemisphere, and with the base slightly convex. One of the largest measured one and one-fourth inches across this base and had a depth of about one inch. They are formed of a single bunch of loose, flocculent material, somewhat firm on the outside, but transparent enough to show the large egg mass within. All were attached by the base to the top of the large breeding cage or to the potted plants enclosed therein. They are white in color. The egg-mass is subspherical and very compact, being glued together, and partly covered by a white, limy secretion. There are several hundred yellowish eggs in each cocoon. After laying her eggs the mother spider, very much shrunken in appearance, soon dies. The eggs probably do not hatch until spring.

TYPE: **Araneus frondosus.**

Perhaps the most common orb-weaver in the East, spinning webs on fences, bridges, or bushes. The cocoons are attached in the angle of timbers close to the web, or, occasionally, to the side of a leaf whose edges are partially drawn together. They are roundish or oval masses of fleecy white silk, held in place by a maze of short radiating lines fastened to the leaf or angle of timbers by attachment disks. They approximate an inch in most dimensions and contain several score of pearly white eggs.

These are slightly agglutinate, and are placed on a felt-like rug somewhat denser in texture than the rest of the cocoon. The young broods are produced late in the summer. I have found some in the egg state and some just hatched the first week in September. The cocoon is too loose to afford much protection, which probably accounts for the spiderlings leaving it early in the fall to spend the winter elsewhere. The adult females are seldom seen about their cocoons, and they disappear entirely at the approach of cold weather.

TYPE: **Meta menardi.**

A spider dwelling in caves, tunnels or dark recesses among the rocks on the side of a gorge. The cocoons are pear-shaped affairs, about seven-eighths inch and five-eighths inch in longest and shortest diameter respectively. They are of pure white, filmy tissue, so transparent that the egg mass can be photographed through the outer envelope by transmitted light. They are suspended by a sort of neck or short pedicle from the roof of the cave. The female remains on or near the cocoon for some time after depositing the eggs. The latter form a small yellow ball, a little more than one-fourth of an inch in diameter, held together by fine threads of tangled silk. They are apparently not agglutinate. They number 300 or 400. The cocooning season for this species is, in the neighborhood of Ithaca, N. Y., the latter part of August and the early days of September. The young spiders soon hatch, but remain in the cocoon through the winter.

TYPE: **Theridiosoma gemmosum.**

The Ray spiders live a retired life along the banks of some creek, where overhanging bushes and projecting rocks afford the gloom they seek. In such locations, especially in the dark recesses under clusters of roots, we may look for their cocoons in midsummer. They are among the most interesting to be found; little golden brown balls, about one-eighth inch in diameter, suspended by a single glossy white thread nearly an inch long. They are paper-like in texture and are attached to this stiff, silken pedicle by a dilation of the latter in the form of a cone. At the time of hatching this little cone lifts up like a lid, adhering by merely a point of the circumference and un-

covering a small, circular hole through which the young escape. The pedicle itself usually hangs suspended from two or three cross lines of silk attached to surrounding objects. From some cocoons collected August 23 the young spiders emerged August 28. Data respecting the eggs are not at hand.

TYPE: **Tetragnatha extensa.**

This spider is abundant in the prairie regions. It does not seem to have the preference for living near water shown by other species of the genus, as it is found on the higher hills as well as along the streams. The cocooning season is early in the year, the species being one of the first orb-weavers to appear in the spring. In the month of May the interesting little cocoons can be found swung by their supporting lines from some convenient object. They are about the size and shape of a cherry-pit—aproximately one-fourth inch in diameter. Each is composed of loose material of a greenish tinge and is covered with projecting tufts of whitish silk. The suspending lines, usually three in number and about an inch in length, support the cocoon like a hammock. They are stretched so tight as to be nearly horizontal. The eggs are agglutinated into a little ball looking like a tiny berry. They are whitish, tinged with brown, and number about sixty. In some cocoons young spiders were found May 20.

TYPE: **Argiope aurantia.**

The Golden garden spider spins its snare in about the same situations as those chosen by *Araneus trifolium*. Its cocoons are easily found in autumn among the goldenrods in or near some marshy place, or down in the matted grass of the marsh itself. They are large, bladder-shaped sacks, a little more than one inch in longest diameter, and having a narrowed neck, to the flaring top of which attachment is made with the lines that support them. They are also held in place by a maze of radiating threads which draw together the leaves and stems of the supporting plant in such a way as to hide and protect the cocoon. The exterior of the cocoon is light brown to dark brown in color, and paper-like in texture. The egg-mass within is again enclosed in a capsule of firm brown tissue, elongate-dome-shaped, with base of dome upward, slightly convex,

and consisting of a felt-like, reddish brown rug, which detaches readily from the other valve of the capsule. Above and below this capsule are masses of brown silk packing. The eggs are yellow, agglutinate, and number from 1000 to 1200.

The egg-laying season begins late in August and continues through a part of September. By the middle of the latter month most of the females, after making provision for the perpetuation of the species, have perished. A few may be found, however, as late as October. The eggs begin to hatch the last of September, but the young remain safely ensconced in the cocoon until the following April or May. The large number of spiders that hatch in the fall has been greatly reduced by the time they emerge in the spring. This circumstance has led some investigators to believe that the inmates of the cocoon resort to cannibalism during their long winter wait. Hymenopterous parasites infest numbers of the cocoons, and a great many others are torn open, apparently by birds.

Type: Argiope trifasciata.

The Banded Argiope lives, by choice, in grassy ravines or meadows, where her web, with the zigzag band across the center, is a common sight in the autumn. The cocoon, of closely woven silk, is fastened by radiating threads among the stems of grass close to the abandoned web. It is well down toward the roots of the tangled grass, and is thus not easily found. It is shaped like a kettle-drum, having a flat top nearly three-fourths of an inch in diameter, and an inverted-dome-shaped base of about the same depth. The head of the drum is a circular brown patch that separates readily from the base. Above it projects a scalloped border furnishing attachment to some of the supporting lines. The color of the base is a sort of tan or cream yellow; it is firmer in texture than the head.

The egg-laying season is later than that of *A. aurantia*. Although two cocoons were secured in the laboratory as early as September 15, none could be found in the fields until the last of October. On the 24th of that month the majority of the females were still in their webs, their abdomens distended with eggs. Two weeks later they had nearly all disappeared and cocoons were plentiful. The eggs are cemented together into a mass nearly as large as that of *aurantia*. They are yellow, and

number several hundred. The young hatch in the early winter but remain in the cocoon until spring. In many cases parasitic Hymenoptera were sharing their winter house.

TYPE: **Cyclosa conica.**

In midsummer we find the cocoons of this small orb-weaver arranged in a string across the center of its vertical web. The string is also partly made up of nodules of silk, trash, and fragments of insects captured by the spider. At the lower end is the tenant herself, scarcely distinguishable from the other elements of the string. The cocoons may be separated by short intervals, or placed so close together as to touch or even overlap slightly. They number from three to five, are elliptical or double-cone-shaped, and are of a yellowish-brown color. Each consists of a single piece of floss, approximately one-fourth inch long and one-eighth inch wide, and close-woven enough to be weather-proof. There are from ten to twenty-five bluish-white eggs in each cocoon of the string. These are not agglutinate. Contrary to the arrangement in *Araneus labyrintheus*, the upper cocoon is the newest one, and may contain eggs while the lower ones are occupied by young spiders.

Family SALTICIDÆ.

The salticid family presents some interesting phases of maternal instinct not found among the orb-weavers. This must necessarily be so, since the mother usually survives the act of ovipositing and watches over the eggs and young, while the orb-weavers, as a rule, perish after laying eggs. Cocooning takes place earlier in the season than is common among the Argiopidæ, so that by the time winter sets in the young are well grown, and spend the cold months snugly ensconsed in silken bags of their own fabrication. In midwinter one may find these bags under stones or bark and in crevices of wood. In some such situations, and also in the seed-tops of weeds and grasses or in clusters of leaves, we find their cocoons in spring and summer. They are always enclosed in an outer sack, in some cases the one in which the female spent the winter. Being thus enclosed they are rather frail, and may be merely pockets in the sides of the dwelling-tube. They are usually, however, lens-shaped affairs, suspended, like a hammock, from its walls.

There may be three or four such cocoons, but more commonly only one. The females remain in the cell with the cocoon during the period of incubation, and until the young are ready to leave the parental nest. In many species they even seal up the cell from the inside, that no marauder may intrude.

TYPE: **Phidippus ferrugineus.**

This large black and rust-colored species I have found only on the limestone hills of central Kansas. The female passes the winter in an oval dwelling-sack of stiff, closely woven tissue, arched on one side, the other flat, and attached to the under surface of a loose stone. Small sticks and bits of leaves are used to partly cover the sack, or at least to surround its base. There is no opening for egress. In April the occupant spins a cocoon of fleecy adhesive silk, attaching it to the walls of the sack. It is depressed spherical or biconvex lens-shaped, pure white, like the sack, and about three-eighths of an inch in greatest diameter. Immediately investing the eggs is an inner envelope of somewhat firmer silk, about as thick and smooth as ordinary tissue paper. The eggs are yellow, not agglutinate, and number about 140. After they hatch the young remain sealed up in the sack with the mother for at least two or three weeks.

TYPE: **Phidippus opifex.**

This species, from California, makes its cocoon nest in some shrub, as sage. It is an egg-shaped mass of white spinning work, about three inches long by two and one-half broad—sometimes less. In August or September the mother spins in this nest from two to four white, lenticular cocoons for her eggs. They are attached to the walls, and shut off from the part of the nest the mother occupies by a thin sheet of web. Each consists of a shallow concave disk on which the eggs are placed and a convex cover for the same fastened down by a few loose threads at the junction. The eggs are pinkish red in color. The young are said to remain in the cottony nest until spring (Davidson).

Family ATYPIDÆ.

Four genera, including six species, of this family of burrowing spiders are accredited to temperate North America—these mainly on the authority of Simon or Hentz. Little has been

recorded concerning their cocooning habits, and, as they are found only in the South or on the Pacific coast, I have had no opportunity to observe them. I present two somewhat conflicting statements relative to the genus *Atypus*—all I could find on this family. "At the bottom the burrow widens out a little in the form of an oblong chamber, and it is at the entrance to this chamber that the female suspends her cocoon, which has the form of a little sack of white, closely woven material" (Simon). "The female deposits her cocoon at the end of her burrow; this is guarded from the dampness of the earth by being placed on a cushion formed of silky flock and the fibers of plants" (Staveley).

Family AVICULARIIDÆ.

Considerable has been written about the interesting habits of these Trap-door spiders of the West and Southwest, but most of the writers seem to have neglected observations with which this paper is concerned.

When the egg-laying season arrives, many species of this family completely close up their burrows by sealing the trap-door to the walls. The single cocoon containing the eggs is then suspended near the bottom of the tube or in one of the chambers, if it has diverticula. The cocoon is a fairly close-woven sack in some species, but in others, particularly of the genera *Bothriocyrtum* and *Cteniza*, the eggs are held in place merely by a few threads. Members of the subfamily Aviculariinæ, like species of the Pholcidæ and Pisauridæ, carry their large, rounded, flabby cocoons about in their cheliceræ until the time of hatching. The young, as a rule, remain for some time in the burrow with the mother, but at an early age are said to build perfect trap-door nests for themselves.

Family CLUBIONIDÆ.

This is a large family, including a number of groups that differ considerably from one another in cocooning habits. With all the diversity, however, the general methods of procedure will usually follow one of three lines. The most common practice is to enclose the more or less lens-shaped cocoon in an outer dwelling-sack, or special incubation cell, like most of the Salticidæ. In a few cases this outer sack is a mere veil of silk, but more often it has thick walls of double or triple tissue, and

may have, in addition, foreign material added for protection. When tube-shaped it is spun in crevices of wood or bark, in stone fences, or in rolled leaves. When larger and more globular it is usually enclosed in a tent of leaves drawn together. In one subfamily, at least (Sparassinæ), the female shuts herself up in the dwelling-sack, with the eggs. In other groups the sack has one or two openings, allowing the mother spider to perform sentinel duty and at the same time to pounce upon stray insects for food. The female in some species is said to defend her nest to the last; in others to leave it at the approach of danger.

In contrast to the above practices, some members of this family merely spin upon rocks or wood a plano-convex cocoon attached by the flat face and having no outer protecting tent. The cocoon itself, in this case, is of strong, paper-like tissue. It is probable that a great many of the dry, parchment cocoons we find on the sides of rocks belong to the genus *Agroeca*. Females of the supergenus Cteneæ are said to guard the otherwise unprotected cocoon.

A third method of procedure is that adopted by the Heteropodeæ. All members of this group that have been observed carry their cocoon about with them, holding it close to the sternum by means of the cheliceræ and pedipalps. The cocoon is disk-shaped and of rather firm tissue.

TYPE: **Trachelas tranquilla.**

Females of this species can be found under bark or in woodpiles. In such situations they spin their cocoons in September and October. The cocoon consists of a low, dome-shaped cap, resting upon a flat disk, which projects beyond the edges of the convex piece so as to form a narrow border. This disk is firmly glued to the surface of the wood or bark. Including the disk, the cocoon is about three-eighths inch in diameter. When first spun it is pure white, glossy, and of paper-like texture. These qualities are not long apparent, however, for the mother covers the entire surface with chewed bits of bark and then spins a light web over the whole. The eggs, thirty or forty in number, are creamy white and slightly agglutinate.

TYPE: **Heteropoda regia.**

The Huntsman spider lives in the sunny South. Specimens sometimes find their way North in bunches of bananas, and inhabit the warerooms in which the fruit is stored. The female of this species, solicitous for the welfare of her progeny, carries the egg-sack about in her cheliceræ, clasped to the sternum. It is a sort of flat, biscuit-shaped affair of two pieces, joined at the circumference. One of the slightly convex surfaces is of paper-like texture, the other a little looser. I have made no further observations upon this species, except to record the finding of a female carrying a sack of eggs on May 29.

Family DICTYNIDÆ.

An interesting family of small, curled-thread weavers. The females show especial solicitude for the welfare of the young, remaining with them in the tangled web, which contains the cocoons, for several weeks after they hatch. It is more than likely that during a part of this time the mother spider supplies them with food; in fact, I have on more than one occasion observed the young of *Amaurobius sylvestris* swarming over and apparently feeding on a fly which the mother had just captured. The cocoons are always little button-shaped affairs, less than one-fourth inch in diameter, attached by a few threads to twig, leaf, woodwork, or stone wall, or enclosed in a little tangle of curled silk in the top of some dead weed. Each spider spins several of these, rearing her broods at intervals during the summer.

TYPE: **Dictyna volucripes.**

This species makes its little irregular web in the seed clusters or tops of weeds. Here the cocoons are placed. Sometimes only one is found; sometimes four or five. Each is button-shaped, about one-eighth inch in diameter, and consists of two slightly convex pieces joined at the circumference. They are pure white and of a texture about like that of thin blotting-paper. I have found cocoons containing eggs from the latter part of June to late in September. The average number of eggs in a cocoon is somewhere near fifteen. They are yellowish white and apparently slightly agglutinate. The mother spider is invariably found in the web with the cocoons. It is evident that she re-

mains there while one brood after another hatches, grows, and disperses. All, adults and young, have disappeared by the time winter arrives.

Family DRASSIDÆ.

Members of the family Drassidæ usually live on the ground, under stones or trash. Two general methods of cocooning seem to obtain. Species of the supergenus Drassodeæ make a flattened cocoon, as, in fact, all drassids do, but, unlike that of other genera, it is equally convex on both sides. In further contrast to that of the other main group in this family, the cocoon is always white and more or less firm, but never paper-like nor glossed. In addition to the cocoon, these spiders construct, in shallow holes under stones, a silken bag to contain the former. The cocoon may be loose in this nest, or it may be attached to the stone, which, lined with silk, forms one side of the dwelling-sack. The female remains on guard inside until some time after the young have hatched. In a few cases they do not thus enclose the cocoon, but watch it from a retreat near by.

In some other genera, as *Pœcilochroa*, *Megamyrmecion*, and *Melanophora*, the cocoon is plano-convex and attached by the flat face. The other face, convex in the center, becomes flat on the border, forming a circular margin. These cocoons are very firm, parchment-like, and glossy. Though commonly white, they are sometimes pink, or even red. They are not enclosed in any nest or sack, but in some cases, at least, are guarded by the female. Spiders of the genus *Gnaphosa* make no sack, but some envelop themselves in a light web at the time of laying eggs. They watch over the cocoon, which is not stiff and glossy in texture, like those mentioned above. Species of *Herpyllus* sometimes place dirt between two layers of silk in the cocoon, or cover the outside with some material resembling the stone to which it is attached.

TYPE: **Drassodes neglectus.**

Early in May males and females of *D. neglectus* are common in mating-sacks under stones, the males having matured two or three weeks before the females were sexually developed. Later in the month and in June one may find, in the same locations, their cocoons cradled in light silk hammocks. They are biscuit-

shaped sacks, a little over three-eighths of an inch in diameter and about one-fourth inch thick, of a texture like thin, flabby, tissue paper. Of the two component valves, the one resting upon the web is flatter and smaller than the other, which is more convex and has a sort of boxed edge. The suture at the junction of the two valves is quite distinct. The eggs, about 100 in number, only partly fill the cocoon. They are whitish and not agglutinate. In every case that came under my observation the mother spider was resting upon and clasping the cocoon.

Family DYSDERIDÆ.

We have but three or four species of this family of spiders in the United States, and these are not common. Members of the genus *Dysdera* shut themselves up in a flattened, oval case to deposit their eggs. This case is white, firm, and often covered with sand or other extraneous matter. According to Simon, the eggs are not enclosed in a special cocoon; merely deposited within the dwelling-sack occupied by the female. In the genus *Segestria*, however, a lens-shaped cocoon of closely woven white tissue is placed in a special incubation cell near the dwelling-tube of the mother spider. As in the case of *Dysdera*, this cell is usually covered with foreign material which adheres firmly to it. The genus *Ariadne*, represented by *A. bicolor*, spins its cocoon in a long dwelling-tube. After hatching, the young remain with the mother a short time.

Family FILISTATIDÆ.

Only a single genus, including two rare species, is found in our country. Simon describes the cocoon as "flattened, flocculent, and entangled in the midst of the web, like that of *Amaurobius*." The cocoon of *Filistata hibernalis*, according to Hentz, is spherical.

Family LEPTONETIDÆ.

One genus, *Usofila*, is said to be represented in temperate North America. The females of the foreign genus *Ochyrocera* have, like *Pholcus*, the habit of carrying their eggs in their chelicerae. These eggs are held together merely by a few threads.

Family LYCOSIDÆ.

The Wolf spiders are represented in temperate North America principally by the two genera, *Lycosa* and *Pardosa*. Many species of both frequent the water exclusively, hiding under stones along the shores of creeks. No other group presents so many interesting phases of the subject under discussion in this paper. All the Lycosidæ, without exception, carry their cocoons suspended from the spinnerets by a few threads of silk. The larger species, when the duties of maternity devolve upon them, become more sedentary than at other times, cease to rove about, and usually excavate a shallow hole or burrow under a rock for a temporary nursery. This retreat they line with silk, and there they remain for a season, rarely leaving home except to capture food near by. The smaller species, on the other hand, wander about as usual, dragging their cocoon with them on the chase. They make no retreat of any kind, and use their silk only for enclosing the eggs.

When the young lycosids hatch they climb upon the body of their mother, clinging fast on all sides by means of tiny threads which they stretch among the hairs. Thus encumbered the female presents an odd appearance, as though she had increased in bulk to twice her ordinary size. The young remain with her for perhaps two weeks, at least until after the second moult. If she be disturbed by an observer the spiderlings scatter in all directions.

The cocoons of the species of *Lycosa* are nearly globular, those of the *Pardosæ* more flattened. In either case they consist of two valves united by a suture, forming a belt of finer tissue, which, in the latter group, is usually quite conspicuous, being lighter colored. Along this zone the two valves separate when the young hatch. The mother is said to aid their egress by biting the threads. Maternal solicitude is very evident in the care bestowed upon the cocoon while the eggs are yet unhatched. If this precious sack be torn from the mother, she will rush about frantically in search of it, and when she finds it again will eagerly grasp it and make off for a place of safety. After a time, if undisturbed, she will again attach it to her spinnerets.

TYPE: **Lycosa carolinensis.**

This is probably the largest species of the family. In the West it has burrowing habits, digging down into the prairie sod to a depth of eight or ten inches. Individuals probably live two or three years, as half- or two-thirds-grown specimens may be taken at any time. In the cocooning season—May and June—the females never roam about, at least not in the daytime. When found with a cocoon they are always in the burrow. The males, however, are frequently seen near the mouth of a burrow or running about. The cocoon, which is attached to the spinnerets of the female, is almost perfectly globular. It varies in size from one-half to three-fourths of an inch in diameter, and is composed of two valves overlapping at the suture. The envelope is quite tough, and is, perhaps, originally white, but all cocoons appear soiled from contact with the damp earth. They enclose from 500 to 600 eggs each. These are not agglutinate. The mother spider valiantly resists any attempt to deprive her of her treasure. When the young have hatched they cluster over her body in such numbers as to make her appear as large as a small mouse.

TYPE: **Pardosa lapidicina.**

A very common spider in the West, frequenting the vicinity of streams, ponds, or gullies. They run swiftly, carrying the body high above the ground on their long legs. The cocooning season seems to cover the greater part of the summer, as females with egg-sacks have been observed from April to August. The cocoon is attached to the spinnerets ordinarily, but, as with the species of *Lycosa*, if it be torn loose the mother will carry it about in her mouth-parts for some time, finally attaching it again by threads. It is biconvex-lens-shaped, one-fourth inch in diameter, and a little over one-eighth inch between the convex faces. It consists of two valves, firm and paper-like, which overlap slightly at the suture. The color is bluish green or bluish drab at first, but this soon fades. Bulging protuberances indicate the crowding of the eggs within. The latter number about 100, are cream yellow in color, and not agglutinate. After hatching, the young are carried about for some days before they escape from the cocoon. After this the mother's back serves as a vehicle of transportation for some days or weeks longer.

Family MIMETIDÆ.

A small family, having two or three representatives in eastern and southern United States. The genus *Mimetus* is said to make one or two oblong cocoons, tapering equally at both ends, which are suspended by many threads connected with a web like that of *Theridion*, in the family Theridiidæ. The mother spider has been observed to watch over these cocoons. The cocoon of our other genus, *Ero*, is characterized in the type description below.

TYPE: **Ero furcata.**

The cocoon of this small spider has been described in detail by the English writer, Blackwall. In the fall months I found a number of cocoons about Ithaca, N. Y., that answered perfectly to the description, and I have, therefore, attributed them to this species. All were empty when found. They are little balloon-shaped affairs, resembling the cocoons of *Theridiosoma gemmosum*. Like the latter, also, they are suspended by a slender pedicle consisting of a bundle of stiff threads about a half-inch long. They are usually attached to the under side of a rock that does not lie flat upon the ground. The cocoon proper is one-eighth of an inch in diameter and composed of silk having a texture about like that of soft paper. It is pale brown in color. Around this is an irregular network made up of large meshes of reddish-brown threads. Some of these threads unite at the top of the cocoon to form the pedicle referred to above. When the young have emerged from the paper-like inner cocoon it is apparently an easy matter to escape through the large open meshes of the outer network.

The eggs are said to be large for the size of the spider, five to twelve in number, of a brown color, and not agglutinate.

Family ŒCOBIIDÆ.

Of this family, the genus *Œcobius* only is accredited to the United States by Simon. Relative to the subject in hand, he says: "Their cocoons are flocculent, slightly transparent, planoconvex, and fixed in place. They contain each seven or eight eggs, which are not agglutinate."

Family OONOPIDÆ.

On the authority of Nathan Banks, this family is given a representative—*Orchestina*—in our spider fauna. The cocoons are, in general, of a similar type, each consisting of a roundish bit of white floss covering a small number of eggs—only two in *Oonops pulcher*. There may be several cocoons, however, for each spider.

Family OXYOPIDÆ.

This family is best known by the genus *Pucetia*, from the Southern states and California. Its two representative species, *P. aurora* and *P. viridans*, suspend their cocoons in a little irregular web stretched for that purpose among leaves and branches. The cocoon is conical, and has little, rough, diverging points, which serve for attachment to the suspending threads. It has no flossy packing, and is made up of a single piece; that is, it has no suture. Hentz speaks of *P. viridans* as watching over her cocoon constantly. In the genus *Oxyopes* the cocoon differs much from that of *Pucetia*. It is discoid, very flat, and firmly attached, like that of *Philodromus*, in the family Thomisidæ.

Family PHOLCIDÆ.

The Long-legged cellar spider, *Pholcus phalangiodes*, is our most common representative. Members of the family in general make no containing sack for the eggs that could properly be called a cocoon. The eggs are simply held together in the form of a small, rounded mass by a few threads of silk. This little ball of animate possibilities is carried about by the female in her cheliceræ and pedipalps until the young are hatched and ready to disperse. The number of eggs is never very large, usually not more than five or six. A foreign species described by Simon carries only two eggs, which, however, are of unusual size. In other foreign species the eggs are brightly colored in shades of violet, brown, and green.

TYPE: **Pholcus phalangiodes.**

This spider may be found in cellars, hanging back downward from the threads of its irregular web. Two females carrying cocoons were taken in a cellar used for storing bananas, September 16. Hentz reports them as cocooning earlier, giving several dates in July when he observed them with their egg-

balls. The latter consist of a rounded agglomeration of perhaps fifteen whitish eggs, held together by a few threads, but having no external covering other than such of these threads as extend from the outer surface of one egg to another. The whole mass is about three-eighths of an inch in diameter, and resembles in shape a small blackberry. It is held in front of the female by means of her cheliceræ and pedipalps. She continues to carry about the little cluster of spiderlings for some days after they hatch. The period of incubation is a little less than two weeks.

Family PISAURIDÆ.

Of the Pisauridæ, two genera, *Dolomedes* and *Pisaura*, are more or less common in the United States. They are wandering spiders, living along streams. One genus of the family, from foreign parts, spins a permanent web, but all the others make use of a web structure only when rearing their broods. All carry their cocoons about with them until the eggs are ready to hatch. Then they spin a silken shelter among leaves and branches, and, depositing their treasure there, guard it jealously and constantly. The young remain for some days or weeks in this shelter, living a sort of communal life. Apparently the mother never deserts them until they disperse to shift for themselves.

Species of the two common genera mentioned above carry their cocoon in the cheliceræ, holding it close to the sternum. Some other genera are more like the Lycosidæ in the manner of carrying the cocoon, for they have it attached to the spinnerets by a bundle of threads. In the first case—those that carry it in the cheliceræ—the cocoon is quite well rounded, and consists of a single piece of continuous tissue; in the second case it is more flattened, and is made up of two valves, one of which, the lower, is quite flat, the other very convex.

TYPE: **Dolomedes rufus.**

A very large, long-legged spider frequenting watercourses. In July and August the female deposits her eggs in a globular cocoon about the size of a common cherry. It is all of one piece and is probably whitish at first, but soon becomes discolored. The mother takes it up and carries it about in her cheliceræ until her instinct tells her that the eggs are about to

hatch, when she prepares a nest for it. This is commonly made by drawing together a bunch of leaves, on bush or herb, with a web of silk. Such a retreat may be three or four inches in diameter. It bears some resemblance to the nest of a tent caterpillar, save that the web is not so dense. For two or three weeks the mother spider watches over this nursery, probably supplying the young with food. If one approaches quietly he always finds the spiderlings massed into a little ball, which, however, breaks up into scores of scurrying atoms at the least alarm. The mother's position is always on the outside of the nest, usually near the lower side.

Family SICARIIDÆ.

These Six-eyed spiders are not at all common in our country. Marx catalogues one species of *Scytodes* and two of *Loxosceles*. Cocooning habits in the two subfamilies, Sicariinæ and Scytodinæ, are in marked contrast. Members of the former group deposit their eggs under the arch of a stone, enclosing them in a thin cocoon of adherent material. This, in turn, they cover over with a layer of fine earth, free from trash and dirt, and so dry that it crumbles readily. The whole has the form of a depressed hemisphere. The Scytodinæ, on the other hand, all carry their cocoons in their cheliceræ, held close to the sternum. They are globular, and brownish or violet in color.

Family THERIDIIDÆ.

A large family of line-weavers, including among its species those that form the familiar cobwebs in buildings. The cocoons are usually round, flabby little balls, several of which are fashioned at intervals during the summer by the same spider. They are hung in the web occupied by the mother, or, in the case of some of the smaller Theridiidæ, placed in the hollow of a leaf whose edges have been drawn together. In these situations they may be further protected by bits of dried leaves, fragments of insects, or little tents of silk. Some species of the genus *Theridula*, departing from the general custom, make only one cocoon, which they carry about attached to their spinnerets. *Theridion carolinum*, a British species, is also said to have this habit. A common practice among some of the smaller species is to pick up a cocoon at the approach of danger, or when its location does not suit the mother, and carry it to

ome other place, there to deposit it or stand clasping it for ours. Some few also are said to clasp their cocoons at all imes except when getting food. After the young have hatched hey remain in the snare with the mother for some time. Blackwall states that during this period *Theridion lineatum* supplies its young with food.

TYPE: **Theridion tepidariorum.**

A common cobweb weaver in outbuildings and in recesses along the rock walls of gorges. At any time from midsummer until long after frost one may find their cocoons suspended in the top of their snares, while the female hangs back downward below them. The number of cocoons varies from two or three to as many as seven. Each one represents a separate brood, and an inspection of all the cocoons in a snare at any particular time will usually reveal some that are deserted, some that contain eggs, and some that are filled with newly hatched young. Such conditions prevail as late as the first days of November. In the warmer part of the season the cocoons have no protective covering of foreign material, but those observed after frost are usually covered with pieces of dead leaves that could not be disposed as found except by design of the mother spider. The cocoons are little, brownish, balloon-shaped objects, with rather weak, flabby walls. They vary a little in size, ranging from one-fifth to one-third of an inch in diameter. Each contains about 250 whitish eggs. These are not agglutinate, but adhere slightly to the loose interior lining of the cocoon. After the young have hatched they cluster around the outer surface of the cocoon for some time.

TYPE: **Theridium lineatum.**

This is one of the species that places its cocoon on the lower side of a leaf, the edges of which are drawn in by silken lines. Under the additional protection of a slight network of white silk, the mother stations herself here to keep watch over her treasure, which, at the approach of danger, she clasps with her palps and fore legs. The cocoon is perfectly round, about one-fourth inch in diameter, of loose texture, and bluish green or grayish in color. It contains from 100 to 160 yellowish-white eggs, not agglutinate. After the young hatch they remain in the nursery with the mother for a long time, and, according to Blackwall, are supplied by her with food.

Family THOMISIDÆ.

The Crab spiders make no web. They lurk in green foliage or flowers during the summer, and in winter species that survive find shelter under the bark of dead trees or under stones and leaves. The cocoons are usually lens-shaped and attached by one side, though sometimes they are free or suspended, like a hammock, in a shelter of leaves. There may be two valves united at the border, which presents, in this case, a little circular fringe. In some cases the cocoon is attached by a few threads within one or more leaves drawn together. Again it can be found in the tops of dead grasses or in flower clusters. Still other chosen sites among some species are the trunk of a tree, the angle of forked twigs, or the arch of a stone. The tissue of the cocoon is sometimes compact, sometimes of a flossy nature and adhering to the touch. It is unlikely that any species makes more than one cocoon in a season. The mother spider is observed to quit her wandering habits and become more sedentary when rearing her brood. In some cases she watches over her eggs and progeny, but several of our common species wander off as soon as the cocoon is finished.

TYPE: **Philodromus vulgaris.**

The cocoon is spun in the fork of a twig, or occasionally in a slight depression on the trunk of a tree or the surface of a stone. The outer covering consists of very stiff, tightly stretched, milk-white silk, getting thinner toward the edges. This encloses the angle between the twig and the branch, curving downwards a little on its upper border. Under this, and not in contact with it, is another similarly stretched fold of less compact silk covering fifteen to twenty reddish eggs. Under the eggs, next to the bark of the twig, is a light carpet of filmy silk. The eggs are not agglutinate, but are entangled somewhat by light threads.

The cocooning season occupies the latter part of September and most of October. The young hatch in a few weeks, but remain in the shelter of the cocoon until spring. The mother spider is never found about the cocoon unless she has not yet given the finishing touches to it.

TYPE: **Xysticus modestus.**

This is a small and not very common species, of sombre hues. The female attaches her plano-convex cocoon lightly to the under side of a stone and stays by it to afford it what material protection she can. It is about a quarter of an inch in diameter and consists of two valves, one of which is flat and attached to the stone; the other convex, forming a cap to the first piece. A narrow border of the former projects beyond the latter. The material of the envelope is thin but firm, and paper-like. It is white in color. The eggs, about twenty-five in number, are not agglutinate. In several instances that came under my observation in June the mother spider was found clasping a cocoon which contained newly hatched young.

Family ULOBORIDÆ.

We have three genera, including five species, of this family in temperate North America. There are two types of cocoons—the oval, plano-convex cocoon of *Hyptiotes*, and the elongate-depressed-cylindrical form of the genus *Uloborus*. The former is attached by the flat face to the side of a twig; the latter is placed, with others of its kind, along one of the rays of the web, like a bead on a string. It is pointed at both ends, and has numerous little projecting tufts which serve for attachment to the threads that hold it in place. In all cases the cocoons are of paper-like tissue. Hentz, speaking of the female of *U. americanus* guarding her cocoon, says that nothing will induce her to leave it, and that if it be torn from its place she will proceed to fasten it down again.

TYPE: **Hyptiotes cavatus.**

This is the Triangle spider, whose interesting snare and peculiar method of manipulating the same were first described by Prof. B. G. Wilder. Nothing was known of its cocooning habits, however, until the series of observations recorded in this paper was begun. Two female spiders, imprisoned in glass tubes the first week in September, furnished the key to the situation by spinning a cocoon each on the cork stopper. After that, by careful search, any number could be found in the field, though nearly all noticed for a week or so were old cocoons of the previous season. They are usually located on the dead

branches of pine, just below a bud, where, by reason of their protective coloration, they are not easily seen. They are small, plano-convex objects, elongate oval in outline, and resembling somewhat certain scale-insects. The average length is from five-sixteenths to three-eighths of an inch, and the width a little over one-eighth of an inch. In texture they are paper-like; in color they differ scarcely at all from the dull gray and brown of the twig. Their most distinctive feature, noticeable only on close inspection, is the presence of fine cross-striations, due to very many parallel lines of silk loops or points, darker in color than the background, and standing up like the pile on velvet. The flat side of the cocoon applied to the twig is white. Old cocoons have a weathered appearance, and show little trace of the striation mentioned above. Each has also, near the down-twig end, a small opening through which the young spiders escaped.

Quite a number of spiders in one locality made the mistake of attaching their cocoons to a red-painted foot-bridge across a small creek. In this situation their gray tints made them very conspicuous; in fact, noticeable at some distance.

Each cocoon contains from five to twelve pale buff eggs, which adhere slightly, although they cannot be called agglutinate. A few freshly spun cocoons were found during the first half of September, but it was not until some two or three weeks later that the majority of the females laid their eggs. Upon the advent of cold weather the eggs were still unhatched; so it is likely that they remain in that condition until spring.

Family ZODARIIDÆ.

Prof. E. Simon credits us with two genera of this family, but Doctor Marx does not catalogue any species in our fauna. Concerning the foreign genus *Zodarion*, Simon says: "They construct, under rocks, a little spherical case of threads, which holds together small bits of stone and foreign bodies; the female shuts herself up there to lay her eggs, which are not very numerous and are enveloped in a little sack of firm white tissue."